

Claims

- [c1] 1. An integrated circuit for providing drive signals to a piezo element of a milli-actuator device in a mass data storage device, comprising:
a driving circuit for selectively driving said piezo element in either a voltage mode or a charge mode; and
a circuit for compensating said driving circuit for a variable number of piezo elements in a charge mode of operation and providing a compensating feedback signal in a voltage mode of operation.
- [c2] 2. The integrated circuit of claim 1 wherein said circuit for compensating said driving circuit for a variable number of piezo elements in a charge mode of operation comprises a circuit for adjusting an output impedance of at least a portion of said driving circuit.
- [c3] 3. The integrated circuit of claim 2 wherein said circuit for adjusting an output impedance of at least a portion of said driving circuit comprises a plurality of resistance providing elements that are selectively connected into the circuit.
- [c4] 4. The integrated circuit of claim 3 wherein said resistance providing elements comprise a plurality of series connected MOSFET devices.
- [c5] 5. The integrated circuit of claim 3 wherein said resistance providing elements comprise a plurality of integrated resistors.
- [c6] 6. The integrated circuit of claim 1 further comprising a circuit for containing command data to specify a mode of operation of said integrated circuit.
- [c7] 7. The integrated circuit of claim 6 further comprising circuitry for configuring said integrated circuit to operate in a voltage mode or a current mode in response to said command data to specify a mode of operation of said integrated circuit.
- [c8] 8. The integrated circuit of claim 6 wherein said piezo element has a number of piezo element devices, and further comprising circuitry for configuring a

parameter of said integrated circuit to compensate for said number of piezo element devices.

[c9] 9. The integrated circuit of claim 8 wherein said parameter is an impedance of at least a portion of said integrated circuit.

[c10] 10. An integrated circuit for providing drive signals to a piezo element of a milli-actuator device in a mass data storage device, said piezo element including a variable number of piezo element devices, comprising:
a Class A amplifier connected to receive input signals for controlling said piezo element;
a Class AB amplifier connected to receive an output from said Class A amplifier to selectively provide either current mode driving signals or voltage mode driving mode signals to said piezo element; and
a circuit for compensating said integrated circuit,
wherein in a charge mode of operation, said circuit for compensating said integrated circuit selectively compensates said Class A amplifier for a variable number of piezo element devices,
and wherein in a voltage mode of operation, said circuit for compensating said integrated circuit provides a compensating feedback signal.

[c11] 11. The integrated circuit of claim 10 wherein said circuit for compensating said driving circuit for a variable number of piezo elements comprises a circuit for adjusting an output impedance of said Class A amplifier.

[c12] 12. The integrated circuit of claim 11 wherein said circuit for adjusting an output impedance of at said Class A amplifier comprises a plurality of resistance providing elements that are selectively connected in said Class A amplifier.

[c13] 13. The integrated circuit of claim 12 wherein said resistance providing elements comprise a plurality of series connected MOSFET devices.

[c14] 14. The integrated circuit of claim 12 wherein said resistance providing elements comprise a plurality of integrated resistors.

- [c15] 15. The integrated circuit of claim 10 further comprising a circuit for containing command data to specify a mode of operation of said integrated circuit.
- [c16] 16. The integrated circuit of claim 15 further comprising circuitry for configuring said integrated circuit to operate in a voltage mode or a current mode in response to said command data to specify a mode of operation of said integrated circuit.
- [c17] 17. The integrated circuit of claim 15 wherein said piezo element has a number of piezo element devices, and further comprising circuitry for configuring a parameter of said integrated circuit to compensate for said number of piezo element devices.
- [c18] 18. The integrated circuit of claim 17 wherein said parameter is an impedance of at least a portion of said integrated circuit.
- [c19] 19. A method for providing drive signals to a piezo element of a milli-actuator device in a mass data storage device, said piezo element including a variable number of piezo element devices, comprising:
selectively driving said piezo element in either a voltage mode or a charge mode; and
compensating said driving circuit for said variable number of piezo element devices in a charge mode of operation and providing a compensating feedback signal in a voltage mode of operation.
- [c20] 20. The method of claim 19 wherein said compensating said driving circuit for a variable number of piezo element devices in a charge mode of operation comprises adjusting an output impedance of at least a portion of said driving circuit.
- [c21] 21. The method of claim 20 wherein said adjusting an output impedance of at least a portion of said driving circuit comprises selectively connecting a plurality of resistance providing elements into the circuit.

- [c22] 22. The method of claim 21 wherein said selectively connecting a plurality of resistance providing elements into the circuit comprises selectively connecting a plurality of series connected MOSFET devices into the circuit.

- [c23] 23. The method of claim 21 wherein said selectively connecting a plurality of resistance providing elements into the circuit comprises selectively connecting a plurality of resistors into the circuit.

- [c24] 24. The method of claim 19 further comprising containing command data to specify a mode of operation of said integrated circuit.

- [c25] 25. The method of claim 24 further comprising configuring said integrated circuit to operate in a voltage mode or a current mode in response to said command data.

- [c26] 26. The method of claim 25 wherein said configuring a parameter of said integrated circuit to compensate for said number of piezo element devices comprises configuring an impedance of at least a portion of said integrated circuit.

- [c27] 27. An integrated circuit for providing drive signals to a piezo element of a milli-actuator device in a mass data storage device, said piezo element including a variable number of piezo element devices, comprising:
 means for selectively driving said piezo element in either a voltage mode or a charge mode; and
 means for compensating said driving circuit for said variable number of piezo element devices in a charge mode of operation and providing a compensating feedback signal in a voltage mode of operation.

- [c28] 28. The integrated circuit of claim 27 wherein said means for compensating said driving circuit for a variable number of piezo element devices in a charge mode of operation comprises means for adjusting an output impedance of at least a portion of said driving circuit.

- [c29] 29. The integrated circuit of claim 28 wherein said means for adjusting an

output impedance of at least a portion of said driving circuit comprises means for selectively connecting a plurality of resistance providing elements into the circuit.

- [c30] 30. The integrated circuit of claim 29 wherein said means for selectively connecting a plurality of resistance providing elements into the circuit comprises means for selectively connecting a plurality of series connected MOSFET devices into the circuit.
- [c31] 31. The integrated circuit of claim 29 wherein said means for selectively connecting a plurality of resistance providing elements into the circuit comprises means for selectively connecting a plurality of resistors into the circuit.
- [c32] 32. The integrated circuit of claim 27 further comprising means for containing command data to specify a mode of operation of said integrated circuit.
- [c33] 33. The integrated circuit of claim 32 further comprising means for configuring said integrated circuit to operate in a voltage mode or a current mode in response to said command data.
- [c34] 34. The integrated circuit of claim 33 wherein said means for configuring a parameter of said integrated circuit to compensate for said number of piezo element devices comprises means for configuring an impedance of at least a portion of said integrated circuit.
- [c35] 35. A mass data storage device, comprising:
an integrated circuit for providing drive signals to a piezo element of a milli-actuator device in a mass data storage device, said integrated circuit including:
a driving circuit for selectively driving said piezo element in either a voltage mode or a charge mode; and
a circuit for compensating said driving circuit for a variable number of piezo elements in a charge mode of operation and providing a compensating

feedback signal in a voltage mode of operation.

[c36] 36. The mass data storage device of claim 35 wherein said circuit for compensating said driving circuit for a variable number of piezo elements in a charge mode of operation comprises a circuit for adjusting an output impedance of at least a portion of said driving circuit.

[c37] 37. The mass data storage device of claim 36 wherein said circuit for adjusting an output impedance of at least a portion of said driving circuit comprises a plurality of resistance providing elements that are selectively connected into the circuit.

[c38] 38. The mass data storage device of claim 37 wherein said resistance providing elements comprise a plurality of series connected MOSFET devices.

[c39] 39. The mass data storage device of claim 37 wherein said resistance providing elements comprise a plurality of integrated resistors.

[c40] 40. The mass data storage device of claim 35 further comprising a circuit for containing command data to specify a mode of operation of said integrated circuit.

[c41] 41. The mass data storage device of claim 40 further comprising circuitry for configuring said integrated circuit to operate in a voltage mode or a current mode in response to said command data to specify a mode of operation of said integrated circuit.

[c42] 42. The mass data storage device of claim 40 wherein said piezo element has a number of piezo element devices, and further comprising circuitry for configuring a parameter of said integrated circuit to compensate for said number of piezo element devices.

[c43] 43. The mass data storage device of claim 42 wherein said parameter is an impedance of at least a portion of said integrated circuit.